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GEOLOGICAL INVESTIGATIONS ON DALAGERS NUNATAKKER, WITH SPECIAL REFERENCE TO METAMORPHOSED BASIC DYKES

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Geological mapping of a group of nunataks in the Frederikshåbs Isblink area (approximately 230 km^2) has revealed different ages of metamorphosed basic dykes within the Precambrian gneisses. The dykes are small but are locally abundant and their presence provides an insight into the complex history of the gneisses. The nunataks are an extension of the pre-Ketilidian gneiss complex of the Frederikshåb area (see Jensen, 1966 and this report) and rock types mapped on the nunataks have much similarity to those of the Frederikshåb area.

General geology

The larger part of the nunataks is composed of biotite gneiss, lesser amounts of hornblende gneiss, granitic gneiss and intercalated or included amphibolitic rocks. Approximately a quarter of the mapped area is composed of a later, grey, medium-grained granite which replaces the gneisses and amphibolitic rocks and which is complexly veined by pegmatites. The amphibolitic rocks are perhaps best interpreted as metavolcanic rocks although within the gneisses they are mainly hornblende schists or banded amphibolites. Some layers contain talc-tremolite balls, ultrabasic schists and agmatised amphibolite.

The gneiss complex is severely deformed, folded and migmatised but it is still possible to recognise at least two ages of metamorphosed basic dykes within it.

The gneiss complex with its metamorphosed old dykes is cut by a variety of younger basic dykes, the oldest of which may possibly be equivalent to the so-called "MD" dykes of the Frederikshåb area (Jensen, 1966).

The metamorphosed basic dykes

In all, approximately 80 discordant metamorphosed basic dykes were recorded in the gneiss complex. Even allowing for variations in plutonic history from one area to another and local variations in intensity and character of migmatisation and deformation which could produce differences in character in dykes of the same age, it seems that at least two ages of discordant metamorphosed basic dykes exist. An older group of dykes which are migmatised and deformed and which have been attacked to varying degrees by the host rock gneisses, can be distinguished from younger dykes which are unmigmatised and which have retained their dyke form with clear contacts with the gneisses. It is possible that the older group of dykes contains intrusions of more than one age but without further field work it is impossible to subdivide the group chronologically.

1) The oldest recognisable discordant basic dykes are seen

in the gneisses. They vary from a few centimetres to 1 m in width and they have been migmatised, granitised, folded and deformed. They are composed of a medium-grained amphibolite displaying a foliation frequently parallel to that of the enclosing gneiss. The dykes have been encroached upon by the surrounding gneiss, occasionally to the extent that the dykes have survived only as inclusions. Other dykes however are less migmatised and these have a more dyke-like form than the heavily migmatised types. Discordance to the gneiss foliation is clear and the dykes cut early migmatitic veins and folds in the gneiss. As well as the dykes, some small irregular basic bodies have been recorded in the gneiss and these have been migmatised and cut by later pegmatites. Some basic bands in the gneisses may also represent old intrusions.

Some dykes cut amphibolitic enclaves in the gneisses, enclaves which appear to be of the same type as the metavolcanics. However, the relationship of all the dykes to the enclaves cannot be established and it is possible that some of the dykes pre-date the metavolcanics or are of the same age. Whatever the case, all the dykes post-date an early phase of gneiss formation and enable early migmatisation, folding and presumably metamorphism to be separated from later migmatisation, folding and reworking of the gneiss.

2) Later metamorphosed basic dykes clearly post-date the main phases of migmatisation of the gneisses and probably the granitisation producing the grey, medium-grained granite. Few discordant basic dykes were seen post-dating the granite but only a limited time was spent mapping the granite. The dykes vary in width from a few centimetres to 4 m. Three generations can be recognised from cross-cutting relationships, the first and third generations being characteristically small, only centimetres in width, and less melanocratic than the second and main generation. Most are amphibolites, some bearing epidote. The dykes cut discordantly through the folded and migmatised gneisses, intercalated amphibolites and discordant pegmatites, and their dyke shape is well preserved. The dykes have been folded but they are not conspicuously migmatised, only being cut be small quartz-feldspar veins and later pegmatites.

There has been some local movement of the gneiss after the dyke emplacement and some dykes are occasionally truncated by bands of gneiss. The quartz-feldspar veins are apparently connected to this activation of the gneiss which pre-dates the formation of the pegmatites.

Metamorphism

The gneisses of the complex appear to have recrystallised under amphibolite facies conditions of metamorphism but mineral assemblages in some of the basic rocks provide evidence of the polymetamorphic nature of the complex. At present, however, only a few thin sections have been investigated.

Hypersthene exists in some of the "amphibolites" of the oldest group of basic intrusions and there is a transition from amphibolites to pyribolites with increase in the pyroxene : amphibole ratio. Samples from one of the basic bodies mentioned in (1) above are pyribolites in which hypersthene exceeds amphibole in amount. Furthermore hypersthene has been noted in some of the metavolcanics. These features suggest that there has been an early granulite facies metamorphism in the area, the mineral assemblages of which have been retrogressed by later metamorphism so that no conspicuous signs of the higher grade remain in the gneisses.

Pre-Gardar (?) dolerite dykes

Dolerite dykes of supposed "MD" age cut sharply through the gneiss-granite-amphibolite complex but they vary in character in the north and south of the nunataks. In the south dykes striking $100-120^{\circ}$ are fresh dolerites with chilled margins. In the north the margins of the $100-120^{\circ}$ dykes are sheared and a swarm of older (?) NE dolerites have conspicuously sheared and foliated margins, a greenish colour and are slightly metamorphosed. A small quartz-feldspar vein has been noted cutting the sheared, foliated quartz-rich margin of one dyke and the host rock gneiss, and in some places apophyses from NE dykes appear to have been deformed.

Conclusions

The original relationship of the supposedly metavolcanic rocks of the complex to the gneisses is not known. There are no dykes which are demonstrably older than the metavolcanics and no palimpsest discordances have been seen between gneisses and metavolcanics. Whether the metavolcanics post-date the initial formation of the gneiss must remain a matter of conjecture, as must any ideas on the existence of very old basement rocks reworked in pre-Ketilidian time. It is clear, however, that reworking of the gneiss occurred at least at two different times post-dating the formation of the metavolcanics. Evidence for this is seen not only by the relationship of both groups of metamorphosed basic dykes to the gneisses but also by actual discordances between gneiss units in the complex and by migmatised and double-folded amphibolitic inclusions within the gneiss, completely isolated within a new foliation.

The metamorphosed basic dykes are small and they cannot be regarded as major dyke swarms capable of separating major divisions of Precambrian history. However, in the area mapped they are extremely useful in recognising and separating plutonic events and they might have a wider application in the Frederikshåb area. For example, the granulite facies metamorphism suggested by the mineralogy of the early basic intrusions may well have taken place farther south over the Frederikshåb area. The history of the gneisses is complicated and at least three fold periods can be recognised, each of which probably contains a number of fold phases. Early migmatisation and folding can be recognised and separated by the oldest basic dykes from later granitisation, pegmatisation, folding and reworking of the gneiss. The younger basic dykes enable the migmatisation, pegmatisation and folding seen affecting the oldest basic dykes to be distinguished from later quartz-feldspar veining, pegmatisation, folding and metamorphism.

The slight metamorphism of the dykes of supposed "MD" age is interpreted as a local phenomenon. There is a possibility of accurately correlating the dykes with dykes farther to the south

in the Frederikshåb area (see S. Bak Jensen, this report) and if by this means a "MD" age can be established, then the metamorphic effects seen in the dykes on Dalagers nunataks may possibly be regarded as a Ketilidian influence.

Reference

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FIELD WORK IN THE FREDERIKSHÅB AREA

Stig Bak Jensen

In 1967 the systematic mapping of the area was continued mainly in the northern part, north of 62°N. It is planned to complete the whole area south of Frederikshåbs Isblink in 1968.

Ten geologists were mapping during the summer, each helped by an assistant. In addition one geologist collected Precambrian fossils from Ketilidian supracrustal rocks in the Ivigtut region (Raunsgaard Pedersen, this report), and one collected samples in the Ivigtut region for age determination.

The field groups were organised in the same way as in 1966, and were served from the base camp Mellembygden. Transport was supplied by two Bell 47J helicopters and one GGU cutter. One helicopter is owned by GGU while the other was chartered from "Heliswiss", Switzerland, who also supplied the pilots and technicians.